ETHNIC WEAPONS

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Inherent in the strategy and tactics of war, there is an intention of destroying members of certain nations or ethnic groups. Put in crude terms, this has been manifested historically by psyching up soldiers to believe in the inferiority of the enemy. In modern warfare this is manifested not only in preparation of the soldier, but also in the strategic design and use of weapons. Examples range from the destruction of food crops of a specific population as was carried out in Vietnam, to the currently existing potential of several nations for immunization of their own troops prior to initiating a biological warfare attack, and to the theoretical use of specific agents directed against the genetic makeup of a target population.

This last concept, conceived in terms of "ethnic weapons", is that a new class of both chemical and biological warfare agents might be designed to exploit naturally existing differences in gene frequencies among specific population groups. In theory, such weapons would possess a capability of incapacitating or killing a selected "enemy" population to a significantly greater extent than a pre-selected population of "friendly" forces. The concept is based on a growing number of findings that many proteins exist in several different genetically controlled forms in human populations. The best known examples of these multiple-form proteins -- called polymorphisms -- are the blood group substances ABO and Rh, and the existence of sickle-cell anemia, due to a variant hemoglobin molecule. These polymorphisms exist in differing frequencies among differing population groups. As an example, blood group type B is practically absent in many tribes of American Indians, while it appears in highest frequency (30-40%) in several population groups of S.E. Asia and S. India.

My awareness of this concept dates from last summer, when I was attending an International meeting on Neurochemistry in Tokyo. During a group discussion

of social issues in the Neurosciences, dealing in part with implications of the new binary nerve gases, a British colleague raised the possibility of ethnic weapons development. Few present had ever heard of this potential exploitation of human genetics for warfare, and no one had information as to whether any serious consideration had been given to this possibility by any military establishment. I therefore decided to find out what I could. If such agents were in an early developmental stage, it seemed highly unlikely that I would obtain any frank admissions, but what I could do as a scientist was to examine the published literature on human genetic variability and assess the feasibility of such warfare. The results of this survey will be presented today.

That such a survey might already have been carried out within the Defense Department is evidenced by an article that appeared in the November, 1970 issue of Military Review, subtitled "The Professional Journal of the U.S. Army". This issue carried an article called simply, "Ethnic Weapons", written by Carl A. Larson, the head of the Department of Human Genetics at the University of Lund, Sweden.

Using many military analogies to describe biochemical processes, the article sketches a relatively few number of polymorphisms and clearly implies, while stopping short of suggesting specific approaches, that the development of chemical agents to exploit these and other polymorphisms can be expected within the immediate future.

When questioned as to why he came to write the article, Larson replied, "There was, to my knowledge, no other way to bring this threatening development out into the open in such a way that civilian and military authorities can say No, we won't have chemical weapons, selective or otherwise, they are simply suicidal". Surely, Larson must appreciate that few civilians and fewer scientists keep up

with military journals, so that his "warning" would be hardly audible outside military circles. As to the military reaction to his article, a letter in Military Review from a U.S. Army colonel, that can be imagined as a representative response, states " . . . the lead article "Ethnic Weapons" is one of the most thought provoking to appear anywhere in some time. The military implications of the research upon which Dr. Larson reported are doubtless greater than any of us realize at this point. I would hope that the article might stimulate further discussion of this matter."

In the interests of stimulating such discussion, the following overview of polymorphic proteins in human populations is presented.

When a survey of biological variation in a population reveals that a given trait (such as activity of an enzyme, or response to a drug) shows a bimodal or polymodal distribution rather than the more usual single bell curve distribution, it indicates that a particular protein may exist in multiple forms that are under genetic control. If the frequency in the population of the less prevalent form is at least 1-2%, as opposed to being present in only one or several families, the protein under study is defined as being polymorphic. To date, approximately 150 polymorphic proteins, mainly localized inside or on the surface of red blood cells, or in plasma, have been described in human populations. While the great majority of these genetic differences are without obvious effects on performance or survival of the individuals, a few aberrant genes, such as that producing sickle-cell anemia, can confer serious clinical disorders.

In reviewing a number of the more striking polymorphisms, we can ask two questions: What are the greatest differences in genotypic or phenotypic

frequencies that have been found between any two population groups? Could these differences be readily exploited for purposes of ethnic warfare?

The first biochemical genetic polymorphism studied in human populations was the blood group substances. The term refers to a class of glycoprotein molecules, detected on the red blood cell surface by specific antibodies. Some 15 blood group systems have been well-defined with at least another 15 not yet definitely classified into systems. The first slide shows the frequency range among populations of the widely studied blood group system ABO. The extremes for type B exist in well separated geographic populations, while the extremes for type A exist between different tribes of U.S. Indians. Combining the data, some 80% of various S.E. Asian populations, and only 5% of pure-blood Cherokees contain either or both substances A and B. The second slide compares gene frequencies of the ABO and several other blood group systems between populations of Western Europe (and therefore of a large proportion of North Americans), and U.S. Blacks. Most of the genes are equally distributed in both population groups, but the Duffy gene Fy makes a clear distinction between them.

Differences in blood group substances should be viewed in the light of findings that many infectious bacteria possess surface antigens that cross-react with ABO blood groups. In the continual struggle of the host-parasite relationship, it appears that many bacteria have evolved with similar or even identical substances to human blood group substances on their surface as a means of camouflaging their presence. This mimickry may well be the basis of an apparent association between ABO blood group type and susceptibility to several bacterial diseases, such as diarrheal infections. Suggestive evidence also exists for association of blood group type with viral diseases such as smallpox and influenza. The ability of certain viruses to add their DNA-containing genetic information onto bacterial

DNA could theoretically be utilized together with the above findings to prepare a potent bacterial ethnic weapon. The one major drawback of this approach, however, is the same as that of biological warfare in general: bacteria, despite all our abilities to manipulate them, remain parasites, and therefore do not long remain in an environment in which they cannot thrive. So-called "friendly" forces, supposedly immune from attack, could likely find themselves equally under attack within a very few generation times - possibly within hours - of a bacteria that had **mutated and multiplied to bite the hand that fed it.**

The next slide shows the highest detected frequencies of the four major variant hemoglobin molecules. Unlike the sickle-cell gene for Hemoglobin S, the genes for Hemoglobins E,C, and D have an extremely restricted geographical distribution, and even in homozygous individuals with a double dose of these genes, there is only occasional mild hemolytic anemia. Hemoglobin S, while often lethal in homozygous individuals, is the classic case of Darwinian evolution at the molecular level. Its distribution in most cases parallels the geographical regions with a current or recent history of endemic malaria, to which the heterozygous condition confers resistance. The main lesson for ethnic weapon feasibility is that the frequencies in the table are for heterozygotes, who possess one variant and one normal gene. Any means of exploiting this genetic trait or most of the others we will soon consider, can only be directed against homozygous individuals who are far less common. The 40% frequencies of Hemoglobin E in N. Thailand, as an example, are accompanied by homozygous frequencies of 5-7%.

The next slide, and the one to follow, lists a few examples from an ever-increasing catalogue of proteins of red blood cells and of plasma that have been found to be polymorphic. The heterozygote gene frequencies of the variant form of the three red cell enzymes each vary from 0-10% to 60-70% among widely separated

population groups. The red cell enzyme, glucose-6-phosphate dehydrogenase, occurs in a large number of variant forms all of which lead to some degree of enzyme deficiency. Since the most common variants can cause hemolytic anemia after exposure of affected individuals to a variety of drugs, this polymorphism will be discussed later under Pharmacogenetics.

The next slide shows the range of distribution among world population groups of the plasma proteins haptoglobin and transferrin, which function as carrier proteins for hemoglobin and iron, respectively. In terms of using variant forms of red cell or plasma proteins as targets for ethnic weapons, the problem of low homozygous frequencies is compounded by the question of how to specifically affect any given protein. It might seem that an array of antibodies, each made against a purified sample of a variant form of a protein, could in themselves constitute an arsenal of ethnic weapons. But to have any hope of a foreign antibody acting against its target protein before the antibody itself was neutralized by the host's immune system, the antibody would most likely have to be injected directly into the blood stream, a highly unfeasible means of delivering a weapon in wartime.

In addition to these biochemical genetic examples of inherited variability in proteins, a sub-category of polymorphisms, known as Pharmacogenetics, serves to focus on inherited conditions that affect how we resond to drugs. The more common of these genetic conditions are summaraized on the next slide under two convenient headings. If a variant form of a protein affects how a drug is absorbed, or how it interacts with a target tissue, the condition is considered to alter the way the drug acts on the body. If the variant protein is an enzyme involved in drug metabolism, the condition is considered to alter the way the body acts on the drug.

Glucose-6-phosphate dehydrogenase (G6PD), as we briefly discussed earlier, is a red cell enzyme that occurs in a large number of variant forms. Affected individuals have a reduced enzyme activity, and in addition, with certain variants, a susceptibility to drug-induced destruction of their red cells. The extent of the drug-induced hemolytic anemia varies considerably among the variant forms of the enzyme. The A^- variant, for example (as seen on a previous slide), is associated with only mild hemolysis, while the Mediterranean variant leads to a severe clinical condition that can also be induced by the fava bean. Of added interest in the G6PD story, is that this is one of the extremely few examples of a polymorphic protein that is X-linked, with the consequent result that far greater percentages of males, who can carry only a single dose of the gene, are susceptible to hemolytic drugs, than are females who can be heterozygous for the condition. Thus, if from the extensive list of drugs known to induce hemolysis, those, or their derivatives, most suitable for use as aerosols were utilized as ethnic weapons, 30-35% of the males of particular populations in Thailand, Greece, and Italy, and up to 60% of the males of one particular group of non-Ashkenazi Jews in Israel could well be seriously incapacitated.

An example of a genetic disorder involving malabsorption is the widespread intolerance to milk among adults of Asian and African populations. The deficiency of the intestinal enzyme lactase, that splits the milk sugar lactose, appears to result in intestinal bloating, cramps, and diarrhea of varying severity. Lactose has approximately one-tenth the solubility in water as the cane and beet sugar, sucrose, and it could become the most unsophisticated weapon of any nation's Chemical Corps.

An example of polymorphisms involving our primary senses is the ability to taste the bitter urea derivative, phenylthiocarbamate, which

is under genetic control. Probably 30% of this audience would be unable to taste the compound, while only 3% of a similar audience in a number of African regions would lack this ability. The response appears connected with thyroid function and correlates with susceptibility to certain forms of goiter. The ability to smell cyanide is also under genetic control.

The final examples involve drug-metabolizing enzymes. Succinylcholine is a short acting muscle relaxant often given during anesthesia. It is normally inactivated by the plasma enzyme pseudocholinesterase, but in some patients the drug results in prolonged muscular paralysis. The highest detected frequencies of the aberrant genes (one producing decreased enzyme activity, the other resulting in a total lack of the enzyme) are 10-15%, figures that are highly significant for anesthesiologists, but not for anyone considering them as the basis of an ethnic weapon.

Variations in the rate of inactivation of the antituberculosis drug isoniazid have also been found among differing population groups. Acetylation via an N-methyl transferase enzyme in liver is a common route of drug inactivation. Slow acetylators range from 5-15% in Eskimos, Japanese, and Chinese, to 70-80% among both Egyptians and Jews. Clinical problems arise when the drug is slowly inactivated, since it appears to induce a long-term peripheral neurological degeneration. A main concern in terms of ethnic weapons potential, lies in the fact that a large number of drugs would be inactivated by a similar route so that the same relative susceptibilities to isoniazid might be present for other drugs that had deleterious side effects of much quicker onset.

In conclusion then, almost without exception, it appears that no gene has been found that will divide any two populations in an absolute sense. On the

other hand, from a military point of view it would probably be argued that the psychological effects on a population of incapacitating or killing 25% of its members cannot be discounted. This, as we have seen, is at least theoretically possible in terms of the gene frequencies of a number of polymorphisms. It must also be considered that forces for specific missions could be selected on the basis of their possessing a divergent genetic makeup from the target population.

It is also likely that only a small fraction of polymorphisms in humans may have been defined to date. One of the pioneers in this field, A.G. Motulsky, has estimated that at least 15% of human proteins are polymorphic, and if the total number of genes specifying proteins is 50,000, then a minimum of 7500 proteins should be polymorphic. With the current list at around 150, we have clearly only scratched the surface. Even among those proteins that have already been described or tested as being polymorphic, the main procedure for such demonstrations, aside from immunological techniques, has been electrophoresis and subsequent staining. It has often been pointed out that many "silent" polymorphisms may exist in which the differences between the variant forms and the "normal" form involve amino acid residues that confer no net change in overall charge of the proteins.

Aside from a literature survey as an attempt to assess the feasibility of ethnic weapons, the main question remains: Is there any visible evidence of Defense Department interest in Human Genetics research? I approached this question again as a scientist - what it needs, instead, is a healthy dose of investigative journalism.

The main results of my efforts have been in learning what channels are available for gaining information about Defense Department sponsored research, and in gaining insights into the structure and function of the Defense Department itself.

My approach was twofold: A routine check of the acknowledgements section of the original papers I read during the literature survey, and the more systematic tack of consulting the 12 volume series, Science and Technology Research in Progress. This reference source provides a cross-index of all grants and contracts that are supported by any branch of the U. S. Government. For example, a check of the volume covering biological sciences under U. S. Department of Defense, subclassification: Army, funding of research in Genetics, subclassification: Population Genetics; showed one listing - "Mapping of Human Blood Groups" - a grant to one of the leading authorities in the field. I then learned of recent legislation called The Freedom of Information Act, which insures that abstracts of all non-classified government supported research are a matter of public record. A computer bank of the abstracts is maintained in Washington by the Smithsonian Science Information Exchange, so I was able to find out that the Army funds were supporting a project during fiscal year 1972, "to prepare maps portraying the geographic distribution of human blood groups and other inherited blood characters." It is not my intention to imply anything necessarily sinister in relating this particular finding, and I hasten to add that the abstract states the maps will form part of a book that is in preparation

for publication. But it is a clear example of the Trojan Horse potential of Defense Department sponsored research, and I submit that investigators receiving such funding should expect to be questioned by their peers concerning any possible military applications of their work. My next example illustrates this position.

Reviewing the acknowledgements of published studies on Human Population Genetics showed, as expected, that the overwhelming majority of work in the area is sponsored by the U. S. National Institutes of Health, by similar governmental organizations in other countries, and by the World Health Organization of the United Nations. However, one series of large-scale screenings of blood proteins in various Asian populations acknowledged partial support from the Advanced Research Projects Agency (ARPA)/Project AGILE with funds "monitored" by the U. S. Public Health Service under ARPA order 580. This was doubly disturbing; first, since ARPA is an agency within the Department of Defense (DOD), and second, because DOD funds were being channeled through the civilian PHS. To be more specific, according to House of Representatives hearings in 1971, ARPA is "an elite group of civilian scientists conducting high risk research and development of a revolutionary nature in areas where defense technology in the United States appears to be falling behind or in areas where we cannot afford the risk of falling behind." Within ARPA is Project AGILE, a counterinsurgency research program responsible for "opening up" limited warfare technologies. During McNamara's tenure as Secretary of Defense, ARPA established a panel of 40 physicists and engineers called the Jason Group to advise the Defense Department how modern technology would best be applied to the theatre of war. Jason is best known for its recommendations on electronic warfare and remote sensing devices for use in Vietnam. In 1963, ARPA order 424 directed the Department of Agriculture to begin a program on

the evaluation of new herbicides and defoliation techniques for killing tropical and sub-tropical vegetation. As a final example, listed in Science and Technology Research in Progress under social sciences, is a range of grants from ARPA to the RAND Corporation for such soft-ware studies as "U. S. Military Options in the Third World". Among the list is a wonderful irony - a grant to a D. Ellsberg entitled "Lessons of Rebellion". Perhaps only through another Daniel Ellsberg, who gains a new concept of the Lessons of Rebellion will we be able to find out if indeed the military is studying ethnic weapons development.

I conveyed the sense of my concern about ARPA being associated with human genetics research in two letters - to a former head of the ARPA/Project AGILE advisory committee (he was listed in an index of federal advisory committees recently published by the Senate Government Operations Committee), and to the head of the laboratory in which the ARPA-supported population screening studies had been carried out. I also mentioned the article in Military Review, and I added that it was not my intent to imply that either had any personal involvement in studies on potential ethnic weapons. I asked for clarification. The former ARPA advisor shared my concern, had never heard the concept of ethnic weapons discussed within ARPA, and had recently contributed to a book on the horrors of future wars that also never considered the concept. In short, a seeming dead end, except that at the bottom of the letter was typed "cc: Dr. S. J. Lukasik", and this spurred me to do what I had not previously considered. I will assume that the understanding was that I would know the identity of Dr. S. J. Lukasik - I did not, but I found out. He is the current head of ARPA, and so I did what I'm sure no citizen can do without some tripidation - I phoned the Defense Department. Dr. Lukasik was out of the country, and the file on ARPA order 580 "has been retired". In fact, they were amazed the order was still being cited since the five-year funding period

had ended in 1969. They would retrieve the file from the archives and phone back, which they did within a week.

In response to my request, they were sorry but a copy of the abstract could not be sent to me. Not because it was classified, but simply that it would be establishing a precedent. But it could be read to me over the phone, slowly enough so that I could copy it down. ARPA order 580 "monitored" by the Nutrition Program, National Center for Chronic Disease Control, U. S. Public Health Service, was:

> "To establish technological and scientific bases for National Nutrition in order to enhance the capability of the Armed Forces of friendly developing countries and of the United States, and to guide maximum utilization of food resources.
>
> Adequate nutrition is the basic need not only of the Armed Forces but of all people. Food and its use has been and is the tool of governments,of politics of war and of conquest. With the presently occurring population explosion the maximum use of science in the feeding of the population becomes one of the world's greatest needs."

ARPA suggested that I contact the Public Health Service for specific details, but hoped this would satisfy me about the general nature of the program, adding that "everybody was starry-eyed about how to help friendly nations with respect to food in those days." ARPA had seemed sincerely helpful, and I was satisfied, but only after I suggested that ARPA was not exactly a benign organization, and explained that "those days", which were 1964-1969, included the specific period when ARPA was funding the Department of Agriculture to develop methods for the deliberate destruction of crops and that the "starry-eyed" abstract in its view of food as a "tool of governments and of conquest" appeared to be a justification for the military use of herbicides.

Shortly thereafter, I received a detailed letter from the head of the laboratory where the studies citing ARPA support had been carried out. I had made a "completely erroneous assumption," and he regretted that "It is apparently

in current fashion to interpret all actions of people in the worst light and not to assume that people may act with only good intentions." He explained that the research on blood proteins of Asian ethnic groups was a personal interest of his and that he had received funds from the ARPA-supported Nutrition Program to purchase laboratory equipment, including several automated Amino Acid Analyzers to carry out these studies. The actual surveys were not funded by ARPA. I thanked him for his candid account, and reminded him that in my first letter I had explained why ARPA funding could justifiably be suspected, and that I had explicitly stated that I was not suggesting he had knowingly contributed to any form of genetic warfare. If I knew Latin, I would create a motto: "Let he who has Defense Department funding be ready for the questions from his peers."

Finally, a phone call to the Director of Public Information of the National Institutes of Health revealed that "monitoring" of funds from the Department of Defense is a rare occurrence.

So we have no "story"; no hard evidence that ethnic weapons are or even have been under consideration by the Department of Defense. We have only the article in Military Review, and the data on polymorphic gene frequencies, showing that differences do exist among population groups that live in widely separate geographic regions, as well as among population groups currently sharing the same territory; and, that genetic differences exist between populations that have been engaged in armed struggles known either as Wars of Liberation, or Counterinsurgency. How these differences in gene frequencies might be exploited for purposes of war can only be imagined, but it must be remembered that the field of Human Polymorphisms has barely been hoed, and future studies may unearth genetic differences that may be even more vulnerable to chemical or biological attack.

The major conclusion at this time is that while the understanding and prevention of hereditary diseases is a generally laudable goal of Human Genetics Research, it is imperative for a ripple of awareness to spread through both the community of scientists engaged in this research, and through the general public, of the possible exploitation of this work for the development of ethnic warfare agents. This awareness must spread, just as the existing awareness of the potential for biological warfare once spread among both bacterial geneticists and the public at large.

Too often in the past the scientific community has learned to its horror the ends to which its seemingly "basic" research efforts had been directed by the Military, and the all too few voices of protest were then heard only after the fact. It is imperative that a concerted voice be raised now, before the spectre of Ethnic Warfare materializes out of the Military's Pandora's Box of weaponry.

ABO BLOOD GROUPS

Population	Phenotype (%)			
	O	A	B	AB
U. S. Indians: Cherokee	95	4	1	0
U. S. Indians: Blackfeet, Blood, and Piegan	17	82	0	1
Laos: Vientiane	23	22	45	10
Vietnam: Mnongs-Nong	20	32	31	17
Vietnam: Mnongs-Rlam	16	37	37	10
India: Madras	32	23	40	5

From Mourant, 1954

BLOOD GROUP GENE FREQUENCIES

System	Gene	Frequency Caucasian	Frequency U. S. Blacks
ABO	O	0.66	0.71
	A^1	0.21	0.14
	A^2	0.07	0.04
	B	0.06	0.11
P	P^1	0.54	0.84
	P^2	0.46	0.16
Lutheran	Lu^a	0.04	0.02
	Lu^b	0.96	0.98
Duffy	Fy^a	0.42	0.05
	Fy^b	0.55	0.12
	Fy	0.03	0.83

From Giblett, 1969

COMMON HEMOGLOBIN POLYMORPHISMS

Variant	Highest Heterozygote Frequency* (%)	
Hb E	35-45	N. India; N. Thailand; S. Vietnam
Hb S	20-25	Uganda; Belize
Hb C	15	Ghana; Upper Volta
Hb D_{Punjab}	3	India (Punjab)

* Frequencies are for distinct ethnic populations within each country listed.

POLYMORPHIC ENZYMES OF HUMAN RED BLOOD CELLS

A. Two main forms: Either can predominate

Enzyme	Range of Heterozygote Gene Frequency of Usually Minor Form (%)	
Phosphoglucomutase	1 - 5	Various S. African tribes
	55 - 57	Finnish Lapps; Habbanite Jews
Acid phosphatase	0 - 5	Indians of Venezuela and Brazil; Habbanite Jews
	57 - 67	Alaskan Indians and Eskimos
Glutamate-pyruvate transaminase	8 - 14	Zambia; Mozambique; Kenya
	69	Filipinos

B. X-linked	Highest frequency (%)*	
Glucose-6-phosphate dehydrogenase		
$G6PD_{Mediterranean}$	58	Kurdistan Jews in Israel
	32 - 35	Thailand; Greece; Italy
$G6PDA^-$	23 - 28	Many African populations
	14	U.S. Blacks

* Frequencies are maximum values since variants other than those listed may have been included in the surveys. (WHO Bulletin,1967)

POLYMORPHIC PROTEINS

OF HUMAN PLASMA

PROTEIN	NATURE OF POLYMORPHISM; HETEROZYGOTE GENE FREQUENCY (%)
Haptoglobin (H_p)	Two main forms; either can predominate
	H_p^1: 5 - 15: many distinct populations throughout India
	87 - 92: tribal populations of Mexico, Venezuela, Nigeria
Transferrin	Many forms; two > 10%
	D_1: 32 - 40: Australian aborigines
	B_{0-1}: 17: Central America (Lancandon)
Pseudocholinesterase (considered under Pharmacogenetics)	

PHARMACOGENETICS

A. Genetic conditions altering the way drugs act on the body

Drug-induced hemolytic anemia - G6PD deficiency

Fava bean-induced hemolytic anemia - G6PD deficiency

Lactose intolerance - lactase deficiency

Taste of phenylthiocarbamate

B. Genetic conditions altering the way the body acts on drugs

Succinylcholine sensitivity - atypical pseudocholinesterase

Slow inactivation of isoniazid - deficient acetylation

- modified from Vesell,1969

SELECTED RESEARCH GUIDE FOR ASSESSING THE FEASIBILITY OF ETHNIC WEAPONS

Presentation of the concept of Ethnic Weapons:

C. A. Larson (1970) Military Review, 50 (#11):3-11, Ethnic Weapons.
SESPA (1971) Science for the People 3:4, Ethnic Weapons.

General introduction to basic areas of human genetics research:

K. Hirschhorn (1973) J. Amer. Med. Assoc. 224:597-604, Human Genetics.

Description and geographical distribution of human polymorphisms:

Proceedings of a symposium on "Genetic Polymorphisms and Diseases in Man" (1973) Isr. J. Med. Sci. 9:1127-1534.

E. R. Giblett (1969) Genetic Markers in Human Blood. F. A. Davis Co., Phila.

A. E. Mourant (1954) The Distribution of the Human Blood Groups. Blackwell, Oxford.

A. E. Mourant et al. (1958) The ABO Blood Groups: Comprehensive Tables and Maps of World Distribution. Blackwell, Oxford.

E. S. Vesell (1969) Adv. Pharmacol. Chemother. 7:1-52. Recent Progress in Pharmacogenetics.

Guide to U. S. Government funding of research:

Government Reports Index
Government Reports Announcements
} Monthly listings and abstracts of ongoing research reports

Science and Technology Research in Progress
12 volume, multidisciplinary, extensively cross-indexed, guide to Government (including Department of Defense) supported grants and contracts. Latest series - 1973.

Smithsonian Science Information Exchange
1730 M Street N.W., Wash. D. C. 20036 (202) 381-5511
Maintains computer bank of abstracts of all government supported research projects. Abstracts are Public Record under the Freedom of Information Act. Write for details.

Background to U. S. Dept. of Defense development of counterinsurgency research programs:

M. Klare (1972) War Without End: American Planning for the Next Vietnams. Vintage.